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Reforms Proposed for the U. S. Patent System

By WALDON FAWCETT

If the confused and chaotic first session of the 72nd Congress of the United States had nothing else to its credit, it might deserve the gratitude of waiting industry for at last giving scope and direction to the erstwhile nebulous project for the modernization of the U. S. Patent System. Manufacturers of dyeing machinery, no less than the textile chemists, who are concerned with processes and designs, as well as mechanical inventions have ample cause to be concerned with the program which has finally taken form.

AT THE outset it may be well to emphasize that the project for bringing ideas of simplicity and consistency to the patent system is designed to produce a permanent administrative structure and has nothing whatever in common with certain emergency measures whereby it has been proposed to relate the patent institution to the latter day derangement of business and the public revenue. It has been proposed to temporarily increase the Patent Office fees as a partial means of balancing the Federal budget. And certain extremists in Congress would declare an inventive holiday for two years in the expectation that suspension of the issuance of patents would check overproduction and stabilize industry. Whatever may be thought of these and other panic-born proposals, they have nothing in common with the movement to revise the patent code in conformity with the needs of the age.

To meet the criticism, in recent years, by invention-dependent industries the current project—expressed in an entire series of separate bills introduced in the 72nd Congress—seeks a dual objective. First, the extension of the legal foundation for the several classes of patents, paving the way for more elastic rules and regulations. Second, the attainment of a number of improvements in the administration of the Patent Office designed to reduce controversial litigation and quicken the issuance of patents. The ample quarters provided for the Patent Office in the new building of the U. S. Department of Commerce—notably the admirable facilities afforded for searches of patent records by attorneys and the public—supply, for the first time, a wholly adequate plant for the clearing house of inventions. It remains only to insure the rapid and relatively frictionless functioning of this machinery.

To provide a permanen to force to classify patents is an innovation proposed in a Bill (H.R. 10741) introduced by Representative Sirovich. By the terms of this Bill the Commissioner of Patents is directed to maintain a classification division in the Patent Office with a personnel of not less than thirty-five examiners whose time shall be devoted exclusively to the classification of patents, including questions of division. The annual expense of this additional force is not to exceed $125,000, an increase that may be readily taken care of in normal times, when the Patent Office is an institution that is more than self-sustaining.

As Chairman of the House of Representatives, Congressman Sirovich has put forward a significant measure in his Bill H. R. 11016. The purpose is to limit the life of a patent to a term commencing with the date of the application. By the revised formula, the term of a patent would begin with the issuance thereof and would terminate at a date not more than twenty years from the date of filing by the applicant in the United States Patent Office of his earliest application disclosing the invention. There is a provision, however, that "for cause shown" the Commissioner of Patents or any court may extend such period by adding not to exceed two years to compensate for delays during the pendency of the application not caused by the applicant.

Chemical and textile interests stand to benefit should Congress approve a program for empowering the assignee of an inventor to file divisional, continuation, renewal

and reissue applications. The Bill to bring this about is numbered, officially, H. R. 11018 and is sponsored by Representative Underwood, who is something of an authority on patent legislation. It is stipulated that patents may be granted and issued or reissued to the assignee of the inventor or discoverer. But the assignment must first be entered of record in the Patent Office. And in all cases of an application by an assignee for the issue of a patent the application shall be made and sworn to by the inventor or discoverer unless the application is based entirely on matters disclosed as a part of the invention by a previously filed application made by the inventor. In that event the application may be made by the assignee of the entire interest, if any. The same conditions are to govern applications for reissues of patents. The statements required to be made in an application are varied appropriately when application is made by an assignee.

Simplification of patent procedure is aimed at in a Bill (H.R. 10154) put forward by Mr. Rich, another member of the Committee on Patents, for the purpose of permitting single signature in patent applications and validating joint patent for sole invention. It is set forth that when two or more persons have made application for letters patent as joint inventors, the subject matter being in whole or in part the invention of a lesser number of the parties applicant, any patent granted shall not be invalid because of misjoinder of the parties. This same bill further amends the Revised Statutes setting forth the rights and procedure when the person who has made any new invention or discovery for which a patent might have been granted, dies or goes insane before the patent is issued.

In planning for additional scope and greater elasticity in the patent laws there has been, on the part of members of the House Committee on Patents an arrangement in cooperation designed to result in revision, piecemeal. Instead of attempting to deal, via one omnibus bill, with all the limitations wherein American invention has outgrown the Federal patent system, the several objectives have been approached through as many separate bills introduced by different members of the Committee. Thus, Representative Swank is the author of a rather revolutionary Bill (H.R. 11010) amending the statute relating to patent disclaimers. By the terms of the contemplated amendment, whenever, through inadvertance, accident or mistake, and without any fraudulent or deceptive intention, a patentee has claimed more than that of which he was the original or first inventor or discoverer, his patent shall be valid for all that part which is truly and justly his own, provided the same is a material or substantial part of the thing patented. Any patentee or his assigns may make disclaimer from such patent of any one or more claims as he shall not choose to claim or to hold by virtue of the patent or assignment.

With the same intent of removing technical obstacles from the path of conscientious, creative invention, Representative Gavagan of the reorganized Committee on Patents has offered a brief amendment (H.R. 10924) to the patent statutes. This Bill would add to the existing law a paragraph to the purport that a reissued patent shall have no effect, other than the effect of the original patent, against any act or acts, indicated or begun in good faith prior to the issuance of the reissued patent. It shall be sufficient for a person sued for infrigement of a reissued patent to prove intervening acts of himself or another of the character contemplated in this special concession.

Striking at supposedly undue prolongation of patent monopolies, Congressman Sirovich has introduced by request a Bill (H.R. 7428) which would demand that all applications for patents shall be completed and prepared for examination within six months after the filing of the application. In default, or upon failure of the applicant to prosecute within six months after any action therein, of which action shall be given to the applicant they would be regarded as abandoned unless it be shown to the satisfaction of the Commissioner of Patents that the delay was unavoidable. Special immunity would be granted to inventions if the head of any Department of the Government certifies to the Commissioner of Patents that secrecy of the invention is essential to the national armament or defense.

As his contribution to the rearranged Congressional symposium of patent law revision, Congressman Kelly of Illinois has put forward a Bill (H.R. 11019) designed to limit inventors to priority of two years before filing applications for patent. According to the wording of the amended section a patent may be granted to any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvements thereof, not known or used by others in this country before his invention or discovery and not patented or described in any printed publication in this or any foreign country before his invention or discovery thereof or more than two years prior to his application, and not in public use or on sale in this country for more than two years prior to his application. In any proceeding involving an application for patent or any suit for law it would be held "to establish invention or discovery" if a contender can submit satisfactory proof of invention or discovery at a date more than two years before the filing of the earliest application by the other claimant.

Pending in the House since early in the year is the Vestal Bill (H. R. 7245) which would amend existing law so that a judgment or decree holding one or more claims of a patent invalid shall not affect the validity of, nor prejudice any rights under any other claims of the patent. Nor shall it affect the validity of, or prejudice any rights under the claims held invalid except as to the parties to the suit in which the decree is entered.

From its inception, the program of reconstruction of the U. S. Patent system has contemplated an overhauling of the Design Patent system. Unlike the other subdivision of the patent system in which textile chemists

(Continued on page 352)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Outing, Northern New England Section, June 10.

* * *

Meeting New York Section, May 27.

* * *

Council and Research Committee Meeting
June 3, 1932—Boston, Mass.

* * *

Outing Mid-West Section in June.

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QUARTERLY MEETING, PIEDMONT SECTION

A QUARTERLY meeting of the Piedmont Section was held on April 23rd, 1932, at the Poinsett Hotel, Greenville, S. C. The meeting was divided into two sections, afternoon and evening. The program was as follows:

Afternoon Session—4 P. M. to 6 P. M.

Enzymes and Their Application to Textiles. Paper and discussion by Dr. D. H. Powers, Rohm and Haas Co.

Suggestions for Lowering Costs in a Finishing Plant. Paper and discussion by L. R. Hiller, Clearwater Mfg. Co.

Slashing of Grey Goods Which Are to Be Subsequently Bleached and Dyed. Paper and discussion by W. S. Boyd, Monaghan Mills, Greenville, S. C.

Relative Merits and Advantages of Peroxide and Chlorine Methods of Bleaching. Paper and discussion by D. D. Leeper, Clearwater Mfg. Co.

Dyeing and Finishing of the Naphthol Reds on Cotton Yarns. Paper and discussion by T. Edgar White, Ciba Co., Inc.

Evening Session—7:30 P. M.

Dinner, 7:30 P. M.

Entertainment—Program by local committee.

Short business session.

Some Effects of Ultra-Violet Rays on Various Colors. Discussion and demonstration by Joseph L. McEwen, National Aniline & Chemical Co.

The Importance of Technical Education in the Textile Industry. Address by Dr. E. W. Sikes, President, Clemson College.

Proceedings of the American Association of Textile Chemists and Colorists

Enzymes*

Their Nature and Their Application to Textiles

By **D. H. POWERS**
The Rohm and Haas Co., Philadelphia, Pa.

Their Nature

THE enzymes are biological *catalysts*. They are organic compounds which living organisms form to catalyze organic reactions. They are similar to the well known inorganic catalysts such as platinum, vanadium oxide, copper chloride or iron oxide. We all know of cases where cotton goods have been weakened or oxidized by the presence of small amounts of a catalyst in the cloth. Goods are frequently tendered by the action of air when the last traces of chromium salts are not washed out. Rubber will sometimes catch fire in the air when a trace of the catalyst copper is present.

These inorganic catalysts play an important role in industrial processes. The use of the catalysts, vanadium or platinum, makes possible the cheap production of sulphuric acid, while the use of aluminum salts catalyzes the formation of anthraquinone, an essential chemical which is used in the fastest of the vat colors. Just as the inorganic catalysts are essential for industrial processes, the enzymes appear to be absolutely essential to catalyze the chemical reactions which occur in the body and are so essential to life, and make possible the assimilation of widely varying foods in building up our bodies.

The enzymes, however, differ from the inorganic catalysts, in that (1) they are extremely specific in their action and (2) up to the present time chemists have not been able to synthesize them. They feel that they may have purified a few of them, but their knowledge of the structure of this class of organic compounds is extremely indefinite.

The specific manner in which these enzymes act is of outstanding interest and value. We find that the enzyme zymase converts only glucose into alcohol and maltase converts only maltose into glucose. But if you mix maltase with glucose no action occurs, just as zymase has no effect on sucrose, maltose or starch.

This specific action of the enzymes is still to be understood or explained. We only know that they are unique in their action and frequently afford the only known method for separating two similar compounds, and often indicate that two compounds which were previously thought identical are different. For example, the use of invertase has made it possible to accurately determine the amount of sucrose in beet sugar factory products.

In contrast to this specific action of the enzymes, the inorganic hydrolyzing agents such as sodium hydroxide or hydrochloric acid are general in their action. For example, sulphuric acid actively catalyzes the hydrolysis of all products that come in contact with it. It would be an ideal agent for use in purifying cotton if it were not for the fact that it acts on the cellulose just as actively as it works on the starches, gums and waxes present. By the time all of the waxes are completely solubilized or hydrolyzed there may be little cotton left.

Some of the more common classes of enzymes are the following:—

(1) *Lipases*—which split fats into glycerol and fatty acids.
(2) *Amylases*—which split starches into maltose.
(3) *Proteases*—which split complex proteins into the more soluble polypeptides or amino acids.
(4) *Zymase*—which converts glucose into alcohol and CO_2.
(5) *Catalase*—which breaks down hydrogen peroxide into H_2O and O_2.
(6) *Reductase*—which reduces some colors to the leuco base.
(7) *Saccharidases*—which convert the saccharides into glucose.
(8) *Cellulases*—which cause a degredation of cellulose.

In the conversion of starch into glucose, at least three different enzymes are required. One amylase converts the insoluble starch into soluble starch. Another enzyme converts this into maltose and maltase converts the maltose into glucose. In removing starch from fabrics, we really only need the first one or two enzymes which solubilize the starch, although we frequently use a mixture of all three and it is very difficult to isolate or separate any particular one of them.

Factors affecting the activity of enzymes are:

Time
Concentration
Temperature
Hydrogen Ion Concentration

*Presented at Quarterly Meeting, Piedmont Section, April 23, 1932.

Time

It is sometimes claimed that a certain enzyme has a certain tremendous activity, but this statement is of little value unless the time during which it is allowed to act is specified. For example, a pound of a dilute amylase will liquefy several million pounds of starch if given a week to act under favorable conditions. It must be remembered that these enzymes are *catalysts* with a high reaction rate. This action is, of course, entirely different from that of most organic chemicals, such as hydrosulphite which is used up itself when it effects a reduction of dyestuff. The amount of work done is dependent on the *time* of reaction.

Concentration

Since these enzymes are catalysts with an extremely high reaction velocity, the *rate* at which we liquefy starch or solubilize protein is dependent on the *concentration* of enzyme employed. While it is frequently common practice to take several hours for most enzyme actions, there is no reason why this *time* could not be shortened to a few minutes or even to a few seconds provided a sufficient concentration of enzyme is used. We usually let one part of enzyme act on a million parts of starch, protein or ester for a long period of time, but in cases where time is an important factor, this reaction rate may be greatly increased by using more enzymes. We find that the amount of starch liquefied varies as the logarithm of the concentration.

Temperature

Since enzymes are complex organic molecules, possibly similar to the proteins, they are extremely sensitive to temperature. In general, the higher the temperature, the faster a reaction is catalyzed. A 10° rise in temperature will generally double the reaction rate, but every enzyme has a temperature above which it is destroyed. A majority of the enzymes will withstand temperatures only slightly above body heat, 98.6° F. (37° C.) since this is where they are found and their original purpose lies in catalyzing body reactions. By careful study some of these enzymes may be stabilized so that they withstand higher temperatures.

There are few enzymes that are not destroyed or gradually inactivated by temperatures about 165° F. Some are destroyed only slowly, but the majority are inactivated extremely rapidly. Incidentally, when enzymes are destroyed by heat, it has not been possible to reactivate or revive them.

Hydrogen Ion Concentration

Every enzyme has a pH range at which it is most effective and it usually loses most of this activity at a slightly different pH. One amylase is active only in a neutral or slightly alkaline solution, while another amylase shows very little, if any, activity under these conditions, and must have an acid meduim in which to do its work. We find that the different enzymes vary in their range of optimum pH from 1.5 to 8.5. The enzyme invertase shows its maximum activity at 4.5 and at a pH of 7.0 or 1.5 it loses 90% of all its action. It is also true that the pH at which an enzyme is active may depend on the source from which it was obtained. For example, lipase from the blood has an optimum pH of about 8.0; while the lipase from gastric juice is reported to have an optimum pH of 4.5. The importance of pH may be appreciated when we realize that much of the research on enzymes carried out prior to 1912 is of little value because the pH at which these studies were made were not noted. Consequently, years of research have been of little value because this factor was not absolutely controlled. It is just as important today, in the industrial application of enzymes, to carefully control the pH at which they are applied if we are to make use of the activity which they possess.

The Application of Enzymes to Textiles

It is evident that these biological catalysts have a place in the textile industry and it is also clear that we must study them if we are to realize to the full the opportunities which they offer. In reviewing the principal classes of enzymes, we see that all types may find practical application. However, their use at the present time is chiefly limited to desizing and refinishing.

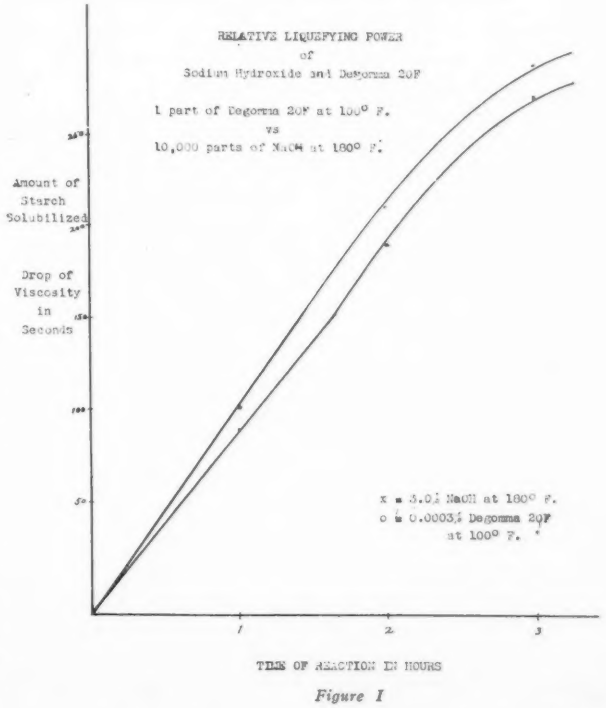

RELATIVE LIQUEFYING POWER
of
Sodium Hydroxide and Degomma 20F
1 part of Degomma 20F at 100° F.
vs
10,000 parts of NaOH at 100° F.
Amount of Starch Solubilized
Drop of Viscosity in Seconds
x = 3.0% NaOH at 100° F.
o = 0.0003% Degomma 20F at 100° F.
1
2
3
TIME OF REACTION IN HOURS

Figure I

Desizing

In sizing warps on the slasher, we find that starches, casein, gelatine, glue, soaps and softeners, and sometimes clay or talc and calcium or magnesium chloride are used and it is with the removal of these compounds that we are concerned.

It is possible to remove these products in a number of ways, but the one method which has no action whatsoever on the cotton cellulose, and is specific in its action on the starches or proteins, is the *specific catalytic* enzyme action. In the actual liquefaction of starches, the curves given in Figure I show the relative activity of an amylase as compared with sodium hydroxide.

We find that this amylase acting at only 100° F. is over ten thousand times as active as sodium hydroxide at 180° F. in solubilizing the starch. By controlling the concentration used, the enzyme may be applied so that it is fully ten times more rapid in its action than the caustic, and far less expensive. We find that in the same period of time, two cents worth of this amylase will liquefy as much starch as twenty dollars worth of sodium hydroxide.

In the recent article by Hall (Am. Dyestuff Reptr. *20*, 715, 1931) he shows from Tschilikim's work that it is extremely difficult to completely remove starch from textile goods. For example, a starch sized fabric when boiled in water and held for 14 hours at 30° C. was not completely freed from starch. Treating for 13 hours in the cold with a powerful wetting agent left a large amount of the starch in the goods, while treating for 14 hours in 0.4% caustic soda at 20° C. did not remove all the starch. In fact, even when a sized fabric was impregnated with caustic soda and treated with moist steam, it could be clearly shown that all of the starch was not removed. Tschilikim also found that either a cold or hot treatment with sulphuric acid only removed a part of the starch. He found that even sulphuric acid which was strong enough to effect a destructive action on the cotton fabric still did not remove all of the starch. The complete removal of the starches could only be satisfactorily obtained by the use of enzymes.

It should be clear that these enzymes are not only specific in their action, not harming or modifying the cellulose, but they are more efficient than even the cheapest and strongest inorganic acids or alkalis on a straight cost basis.

The general plant method for removing sizing is usually one of the following:

(1) In a pad box after singeing.

(2) On the jig.

(3) In a continuous machine.

At least one hour is usually allowed for desizing and frequently from 3 hours to 10 hours is taken. However, there is no reason why it may not be carried out in 15 minutes if somewhat higher concentrations of amylase is used and special precautions are taken to *insure penetration.*

An extremely active enzyme is of no value unless it can penetrate into the yarn. To insure penetration into a tightly woven fabric a heavy set on the pad roller is necessary, and flexing of the fabric during the desizing is advisable. Where it is not possible to get this, sufficient time must be allowed to insure thorough wetting out. The curves showing the effect of *time* of action and of enzyme *concentration* clearly show that it is possible to effectively desize in a very short time under properly controlled conditions. In these curves the amount of starch liquefied is determined by the drop in viscosity of a starch paste. The decrease in the number of seconds required by the paste to flow through a viscometer tube is plotted against the *concentration* of enzyme used, holding the *temperature, pH and time* constant. (See Figure II.) In the curve in Figure III the per cent of starch liquefied is plotted against the *time* during which the enzyme is allowed to act.

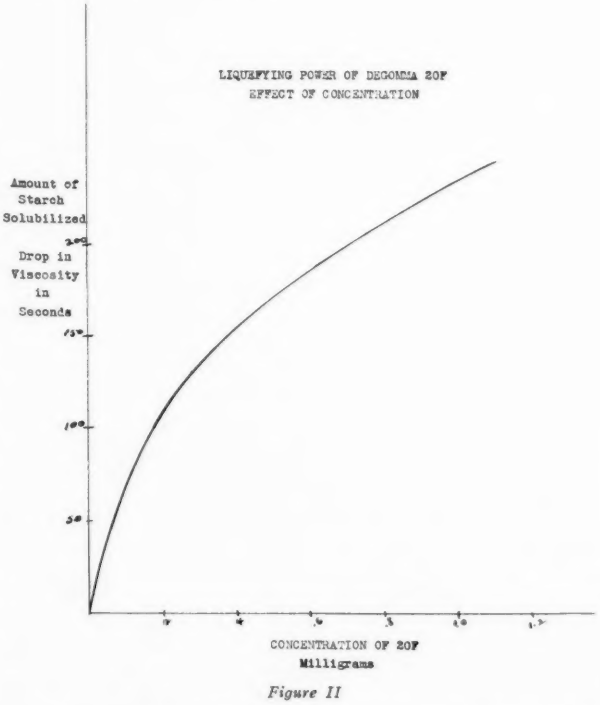


Figure II

For each curve the temperature, pH and concentration of enzyme are held constant. By comparing the curves for the different temperatures we are able to work out the time—temperature relationship. For example, 15 minutes at 125° F. gives as much desizing as 50 minutes at 85° F. It is clear that the time may be shortened with increasing concentration or temperature to give equivalent results. Clearly each mill can adjust the length of time

during which a fabric is treated and vary the concentration of amylase according to its own plant conditions. We find, for example, that a five-minute desizing is theoretically possible when there is perfect penetration, just as a two-hour desizing requires much less amylase to give equivalent results.

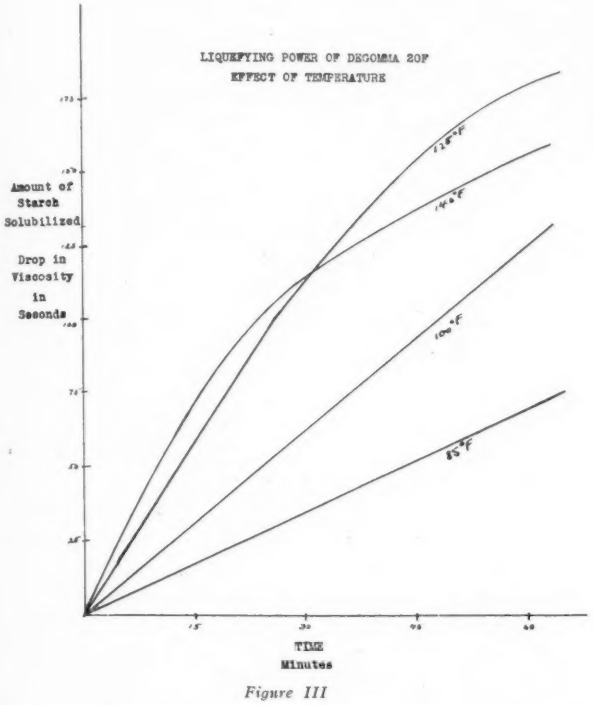


Figure III

The desizing action of an enzyme may be compared to the use of stevedores in the unloading of a freighter. If you use a lot of stevedores (i.e., high concentration of amylase) the boat is quickly unloaded. If you use *too many* they get in each others way and little increase in the rate of unloading is noted, consequently there is a most effective concentration to use. If you have plenty of time, one or two stevedores can unload the whole boat, but most ship owners find it more economical to save time and to use as many helpers as convenient. In a similar fashion, the stevedores are more efficient at higher and higher temperatures until you reach a point where they begin to get less efficient; they collapse, they have heat stroke, they are no longer any good for unloading a boat, so, the amylase is more effective at higher and higher temperatures until it finally begins to lose activity and is killed. As a further analogy—the stevedores are more efficient in working at a certain oxygen content of the air (pH), if it gets below that point they suffocate and they are much less efficient, and if there is too high an oxygen content of the air, they burn up. Similarly, all of the enzymes are most effective at a given acidity or alkalinity (pH). A change above or below that point materially decreases their activity.

The curves in Figure IV and Figure V show the effect of the change in pH and temperature on the activity of amylase. In general, the commercial desizing amylases are compounded so that they may be dissolved in water and will adjust the solution to the pH at which they are most efficient. Although the technical products in use vary in their range from those which requires an acid solution, to those which require a slightly alkaline one, they are prepared so that they may be dissolved in plant water without loss of activity.

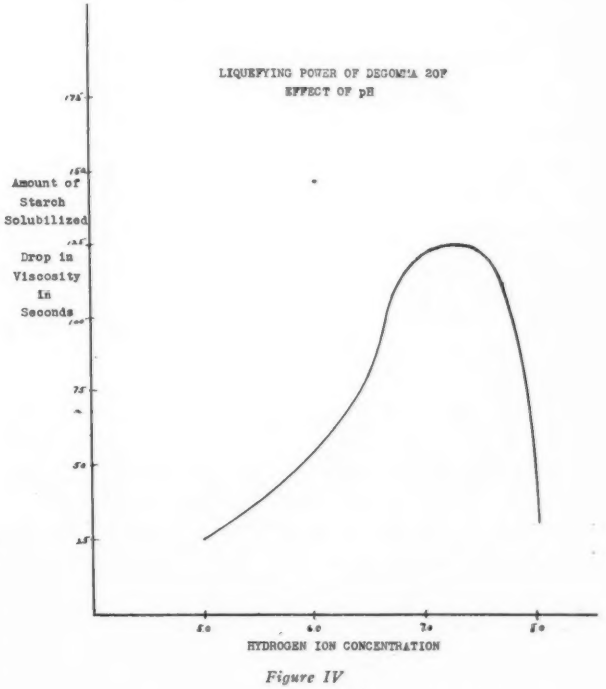

LIQUEFYING POWER OF DEGOMIA 20F
EFFECT OF pH
Amount of Starch Solubilized
Drop in Viscosity In Seconds
HYDROGEN ION CONCENTRATION

Figure IV

It is possible to work with a mixture of two amylases at a pH where one is most effective and the other is completely inactive. It will also be noted that the optimum temperature for using a given enzyme is dependent on the time over which it is going to work. (See curves in Figure V.) With a short time for desizing, the higher temperature is generally better. It must be remembered that, whenever goods are wet out after singeing and allowed to stand overnight wet with the desizing solution, the actual temperature of desizing is room temperature.

The facts relating to the application of amylases or starch liquefying enzymes are equally applicable to the proteases or protein solubilizing enzymes. These proteases are particularly valuable in present-day desizing where we must remove more and more protein materials

such as glue, casein, or gelatine from our fabrics. A combination of amylases and protease should effectively liquefy all the different types of sizes which we meet at the present time.

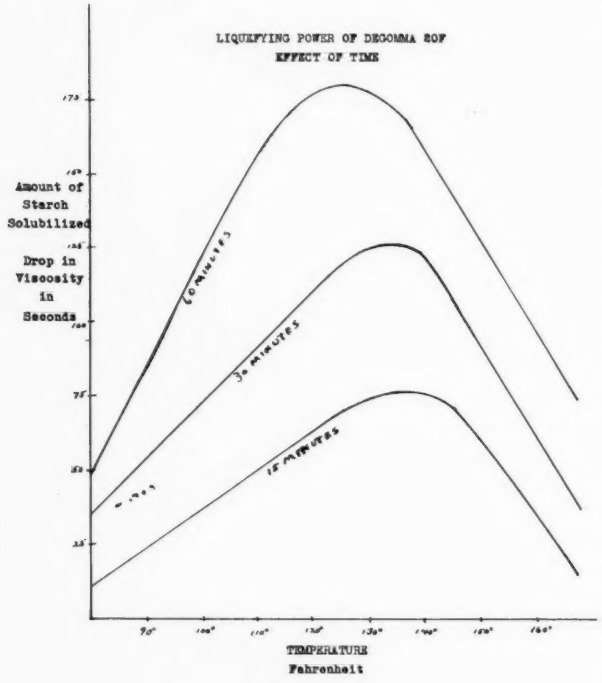


Figure V

In desizing with enzymes the first essential is *penetration* of the enzyme solution into the fiber. If this solution is at the proper *pH* and at a safe *temperature,* it is amazing what a tremendous amount of work a small amount of enzyme will do. In other words, if you will take care of your enzymes they will repay you a thousand fold.

Refinishing

A fabric finished with starch or gum frequently sets up and is too stiff or harsh to merchandise. It is usually necessary to wash this finish out and repeat the finishing operation using less starch or gum. The use of an enzyme with its specific action greatly simplifies this operation. Where it is essential to remove the finish, the goods may be padded through a weak solution of an amylase or protease, batched warm and allowed to stand for one to two hours, the finishing materials are then solubilized and may be readily washed out.

In many cases where the finish is too stiff it is possible to pad the goods through a dilute solution of enzyme, and either batch up warm or plait into a box and allow them to stand for a few hours. At the end of this time the goods are dried on a frame or on cans and are much softer even without any washing, since the enzyme has solubilized the starches and gums. This latter method saves two operations and is particularly applicable where goods cannot be washed for fear of changing the shade. This method is also of value for softening blotch prints which frequently finish up too stiff due to traces of starch or gums which are left in the goods.

Evaluation of Enzymes

No discussion of enzymes would be complete without some mention of methods for their evaluation. This is a subject which has had considerable study and accurate methods are few and far between, and are only of value in the hands of a skilled operator. No chemical analysis is of any value, as we have little real knowledge of their chemical composition. Our only means of evaluation is to measure under carefully controlled conditions the work they do and it is surprising how careful and painstakingly checked these conditions must be.

The chief methods which have been tried are (1) change of viscosity of a starch paste produced by amylase (Davidson, Johns Hopkins Hospital Bull., *30,* 281, 1925), (2) measurement of the amount of sugar formed (Harada, Ind. Eng. Chem. Anal. Ed., *3,* 1, 1931), (3) determine the amount of amylase that will digest 250 cc. of 1% starch paste in 30 min. at 40° C. so that it will not give a color change with iodine (Sherman, Kendall & Clark, J. Am. Chem. Soc., *32,* 1082, 1910). In determining the desizing action of an enzyme, the liquefaction method is clearly the most accurate since it has been shown that the amount of reducing sugar formed by a commercial enzyme is not at all related to its solubilizing power. The liquefaction method has recently been carefully worked out by Jozsa and Gore (Ind. Eng. Chem. Anal. Ed., *2,* 26, 1930). This method consists in accurately determining the drop in the viscosity of a 6% starch paste which has been stirred in an arbitrary reproducible manner for 10 minutes. Less than a thousandth of one per cent of enzyme is allowed to act on the starch for one hour at a controlled pH and temperature. This method is not at all suited to mill use or ordinary laboratory routine analysis as it is very sensitive to slight variations in method and temperature and a trace of impurity will invalidate the results. It has the further practical handicap that it takes several hours to make a single determination.

From a plant point of view it would be preferable to determine the desizing action of an enzyme on the cloth which it was to be used. Clibbens and Geake (J. Textile Inst. *22,* T465, 1931) have given a method for determining the sizing in a piece of cloth which consists in treating a fabric with a desizing enzyme and wringing it out by hand twelve times in a stream of running water. This method has the disadvantage of depending on the variable, wringing out by hand. The following method has been developed and is suggested as a general method for de-

termining the amount of size in a fabric. It is possible that by certain modifications it may find application as a means of evaluating the different enzymes.

A ten gram (10 gr.) sample of grey cloth dried to constant weight is accurately weighed out and placed in a Launder-Ometer jar and covered with 200 c.c. of a 5% desizing solution. (Where a Launder-Ometer is not available, a Mason jar may be used, and shaken by hand at frequent intervals, keeping the solution at the desired temperature.) Add ten to twenty Monel metal balls and rotate the jar in the Launder-Ometer for one-half hour at 135° F. Drain and pour in 200 c.c. of one-half per cent soap solution, rotate in the Launder-Ometer at 160° F. for fifteen minutes. Drain, add 200 c.c. of water and run for 15 minutes at 160° F. and drain. Dry to constant weight. The loss in weight divided by the weight of the desized cloth gives the total material removed. Three per cent of the total weight of the cloth is subtracted from the loss in weight as an average correction for waxes and non-sizing materials and gums removed from the cellulose and should not be figured as sizing material. With rayon fabrics this correction should not be made. This correction of 3 per cent is based on the extensive studies made by Clibbens and Geake, on American, Egyptian and South American cotton.

The method outlined here is offered for your investigation and consideration. Omission of any one of the steps have given results which were not concordant. It is believed that it may offer a simple practical plant method eliminating the need for exactly buffered solutions, carefully calibrated viscosity tubes and accurately standardized starch pastes.

In conclusion, the enzymes are powerful organic catalysts which are rapid and specific in their action. On account of their complex structure they must be used under controlled conditions of pH and temperature. If reasonable care is given to their application, they will prove of inestimable value to the textile bleacher, dyer and finisher. Their possible range of application has by no means been exhausted and a realization of their unique qualities leads one to the conclusion that we are just beginning to make use of the possibilities of these complex organic catalysts which plant and animal organisms contribute to make life possible.

The author wishes to express his indebtedness to Dr. J. J. Willaman for his helpful suggestions and to Mr. E. W. Clark who carried out many of the experiments.

Some Effects of Ultra-Violet Light Upon Certain Articles and Colors*

By **JOSEPH L. McEWEN**
National Aniline & Chemical Co.

THE subject matter of this paper is ultra-violet light and some of the effects it gives upon certain articles and colors. My purpose is not to reveal to you anything very new or startling, but to call to your attention various known effects which are caused by ultra-violet radiation and to arouse in your minds questions as to the importance of these effects and how they might possibly be utilized in the textile industry.

Ultra-Violet Light

To begin with, let me briefly explain what ultra-violet light is. If we take an ordinary glass prism and pass sunlight through it, we find that the sunlight is broken up into a band of vari-colored light, ranging from red on one end to violet on the other and known as the ordinary spectrum. These colors of the spectrum—red orange, yellow, green, blue, indigo and violet—taken together, make up what we know as visible light; that is, light that is of such frequency and wave length that it registers upon the retina of the eye. The longest rays of light that the eye can detect are at the red end of the spectrum, while the shortest ones are at the violet end. These red rays measure approximately one fifty-thousandth of an inch from the crest of one wave to that of the next. The visible violet rays are about one hundred-thousandth of an inch, or only half as long as the red rays. Within these two limits we find the entire range of visible light.

Other Rays

But there are many other rays, which, while invisible to us, have every property and characteristic of these

*Presented at Quarterly Meeting, Piedmont Section, April 23, 1932.

visible rays. Science has so advanced our knowledge that we now have what is known as the complete electromagnetic spectrum. The accompanying diagram of the ether spectrum shows clearly the relative positions and fields of these various radiations.

Measurements

Radiations or rays of this nature are measured in wave lengths or frequencies, and are expressed in Angström units. An Angström is one ten-billionth of a meter and was adopted merely as a simple method of expressing these minute distances. We could measure a table in miles, but for convenience we find it better to use inches and feet. In the same manner we use Angströms, rather than the more cumbersome inches and feet, when dealing with light rays.

By reference to the above diagram we see that visible light is made up of rays of the magnitude of 4000 to 8000 Angströms. Any ray of light whose wave length is, approximately speaking, less than 4000 or greater than 8000 Angströms is invisible. Consequently, the field of the ultra-violet radiation, which lies just to the right of the visible field in the diagram, is made up of invisible rays. These rays range in wave length from about 4000 down to 136 Angströms. Going further to the right, we find the still shorter X-rays. Below these are the gamma rays, which are very short indeed and which are spontaneously emitted from radium. Then come the shortest rays of all—the cosmic rays—which reach us from somewhere in interstellar space and concerning which we know very little as yet.

To the left of the visible band of rays, we find the field of the infra-red radiation; rays that are too long to be visible but which we can feel as heat. Just above the infra-red are the Hertzian waves, with wave lengths getting longer and longer. On beyond are the waves that are used in radio broadcasting. These days are very long, measuring anywhere from 10 to 30,000 meters from crest to crest. The complete spectrum embraces thus wave lengths from 3 x 10^{14} Angströms down to those approaching the magnitude of .0001 Angström. All these various fields have no sharp line of demarcation, but overlap each other smoothly—much like the colored bands of light in the ordinary spectrum.

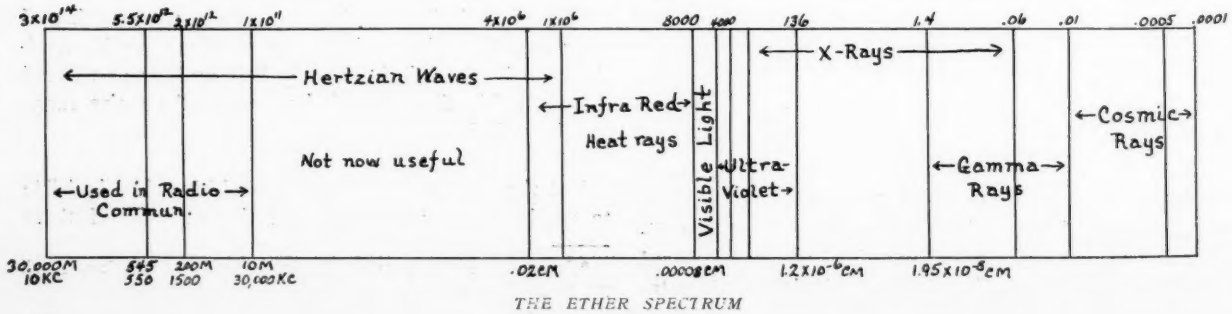
Effects

Now that we understand the kind of rays that make up the ultra-violet, and their position relative to the other rays, let us take up some of their effects. Observations in this field are commonly made either by means of the photographic plate, or through the phenomenon known as "fluorescence." When light falls upon a body it may be partly reflected, partly transmitted, or partly absorbed. This absorbed energy does not always appear as heat and, in some cases, is re-emitted as light of a different character from that of the incident beam. This secondary radiation is usually of a longer wave length than that of the exciting light. Objects possessing this property are called fluorescent—after fluorspar, in which the phenomenon was first observed. In cases where the secondary radiation continues after the exciting radiation is removed, the phenomenon is known as "phosphorescence."

An enormous number of things are fluorescent. Among them I mention only briefly—oils, fats, waxes, bacteria, blood, milk, hair, teeth, minerals, certain gems, dyestuffs, and even wine. These things vary greatly, of course, in the degree to which they exhibit this phenomenon. Many of them, such as mineral oils and weak solutions of fluorescent dyes, show the phenomenon in full daylight. The organic dyes, fluorescein and eosin, are very notable in this respect. In other things visible light is often insufficient to excite fluorescence. In all cases, fluorescent radiation is much more effective where other visible light is removed. This can best be accomplished by using a light source that is rich in ultra-violet and employing a suitable filter to exclude the visible light.

Some organic dyestuffs, in addition to showing fluorescence in solution, act like fluorescent paints in that fabrics dyed with them also fluoresce when viewed under ultra-violet light. Thioflavine S, Auramine O, Rhodamine B and 6G are examples which give very good effects. Others such as fluorescein, eosin, erythrosin, and the phosphines, show fluorescence but not as brilliantly. To secure the best results both dye and fabric must be

Angström Units



THE ETHER SPECTRUM

chosen with care. It appears that luster of the fiber has a pronounced effect since silk and artificial silks seem to yield better results than cotton. The depth of shade also has a great deal to do with the phenomenon, weaker shades fluorescing brighter than heavy shades made with the same dye. Some dyestuffs which show fluorescence in visible light fail to do so under the ultra-violet. Different solvents also frequently cause the same dye to fluoresce differently. Phenosafranine, for instance, gives only a weakly fluorescing solution in water, but a most brilliant one in acetone.

I might continue indefinitely in this manner, giving you other examples of this phenomenon, if time and space permitted. I have mentioned, however, only some of the more outstanding instances. I have prepared quite a few sample dyeings which I will show you later under the effect of ultra-violet.

Applications

You are probably thinking by this time—"This is all very well and quite interesting, but does it have any practical application?" And my answer is that it has practical possibilities though little use has been made of them as yet. Phosphorescent materials, since they continue to glow after the exciting light is removed, have found a wider field of use than fluorescent ones. Such uses as for signs, life-buoys, push-buttons, key holes, etc., are obvious. Fluorescent things, however, when properly illuminated with ultra-violet light, frequently give more striking effects than phosphorescent ones do. Very novel and unique results have been secured on the stage through the use of fluorescent dyes, paints and lacquers. Another field, which is as yet practically unopened, is their use for display purposes. Very attractive and unusual window displays can be arranged by using fabrics dyed with fluorescent dyes and show-cards lettered with fluorescent lacquers. There are doubtless many other possible uses which inventive minds will discover as occasion arises. It is sufficient to say that the whole idea of using ultra-violet for such purposes is so new, and so little has been done, that no one knows just what is possible. Time alone will tell the story.

Light is a very important thing to the textile chemist and colorist. You all know that you must have a good source of light in order to match shades properly. A certain shade in one light becomes something else entirely in another. I refer here to visible light only. Since this is true, isn't it natural to expect that there would be a relatively greater difference if we looked at the same shade under ultra-violet light? These thoughts bring other questions to our minds. What causes the phenomenon of fluorescence and phosphorescence? It is a property of chemical structure and composition, or what? What other effects, if any, does ultra-violet have on dyes? We know that it produces more rapid fading than ordinary light. Just why is this? Is it possible for us to produce dyes which will minimize this fading effect? Do our fastest dyes, such as sulphurs, vats, and naphthols, already possess this property of resistance to fading by ultra-violet? If so, what is there in their structure or composition which gives them this power? All these and other questions will doubtless be answered in time. Certain it is that the subject is most interesting and it is entirely possible that it may some day develop into something that will be of tremendous importance to the textile industry.

In concluding I wish to express my appreciation to Mr. Roy A. Palmer of the Southern Public Utilities Co., of Charlotte, for lending me the ultra-violet lamp and for his very helpful aids and suggestions in preparing this paper and demonstration. Anyone interested in ultra-violet light, beyond the scope of these brief remarks, would do well to communicate with him at his office in Charlotte.

SEVENTY THIRD MEETING OF THE RESEARCH COMMITTEE

The Seventy-third Meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Bureau of Standards, Washington, D. C., April 1, 1932.

The following were present:—

Chairman, L. A. Olney
Wm. D. Appel
P. J. Ariente
Henry F. Herrmann
Milton Harris
Heyward F. Lawton
Dr. Hans Meyer
Dr. D. H. Powers
Dr. Walter M. Scott
William C. Smith
Walter S. Williams
Secretary, A. Newton Graves

Reports for inability to attend were received from P. J. Wood, Wm. R. Moorhouse, Carl Z. Draves, E. H. Killheffer and R. E. Rose.

Fastness Test for Dyed Silk

Walter M. Scott reported for the Sub-Committee on Fastness Tests for Dyed Silk. The desirability of methods of testing dyed silk for fastness to peroxide bleaching was discussed, and as a result of favorable comment, the chairman asked the committee to formulate such a method and report later.

Light Fastness

The report of the Sub-Committee on Light Fastness was read by the chairman in the absence of Mr. Cady. The report was as follows:

Through the courtesy of Dr. Paul Krais, of the German Echtheitskommission, a complete set of the official dyeings prepared under the auspices of that organization for use as light standards was sent to our Committee for a practical trial in this country. The dyeings comprised eight on cotton, eight on wool, and five each on unweighted silk, weighted silk, viscose, and acetate silk. They were exposed to the sun at the Bureau of Standards during 1931 by William C. Smith, Research Associate of the A.A.T.C.C., these exposures including both our standard sun test (under glass, but with free circulation of air, facing due south at an angle of 45°, between the hours of 9 and 3 on sunny days only, during the summer months) and a continuous sun test (like the standard test but exposed in a vertical position continuously day and night and in all weathers; this is the German method). In addition, the dyeings were tested in the Fade-Ometer.

The conclusions reached by our Committee are as follows: the wool standards are in all respects the best, and with one or possibly two exceptions may be considered reasonably satisfactory. The other sets of standards are all open to objection, for one reason or another, and since this is the case, it would seem desirable for the Echtheitskommission to drop them all and use only the wool dyeings as standards for all fibers. There is a strong tendency towards a single set of standards in both England and the United States, and also, it is reported, in Germany. Since there is a great similarity between six of the eight German standards on wool and the six tentative standards (also on wool) selected by our Committee (see the 1931 Year Book), it seems reasonable to hope that ultimately a set of international standards constructed along these lines will be adopted.

Color Standardization

It was suggested by Dr. Scott and approved by the committee that Dr. Draves be added to the personnel of the Sub-Committee on Color Standardization.

Fastness Test for Dyed Wool

In the absence of Mr. Christison the Chairman of the Sub-Committee on Fastness Tests for Dyed Wool, and also of Mr. Ryberg our Research Associate who has been doing the laboratory work for this committee, the chairman reported at considerable length describing the various series of experiments and different investigations which have resulted in the present method, which is to be published in tentative form in the 1931 Year Book. For some time it has been believed that it would be impracticable to work out a laboratory method for determining fastness to fulling of dyed woolen material, but the committee has every reason to believe that through the use of the Launder-Ometer a method has at last been devised which is better than the practical fulling test as carried out in the mill.

Research Program

Dr. Powers made a report for the Sub-Committee on Research Program and a tentative program for the coming year was outlined.

Research Associates

Reports were given by Mr. William C. Smith and Dr. Milton Harris, two of our Research Associates descriptive of some of the work that they have been doing during the past few months.

Mr. Smith spoke particularly in regard to the relatively extensive experiments which have been conducted at the Bureau of Standards in connection with the resistance of waterproofed materials. He also described some of the work in connection with weather exposure and laboratory ageing treatments. He described some of the work in connection with the light fastness tests and referred particularly to a series of comparative Fade-Ometer and sunlight tests, which were being conducted in connection with the establishment of standards, also, another series of tests in which the Fade-Ometer was being compared with the Fugit-Ometer. He also reported in regard to tests which had been made in connection with Krais test papers for measuring light fading. A preliminary report was also made by Mr. Smith regarding work which he had done in connection with the effect of acidity and alkalinity on the deterioration of cotton cloth on exposure to light.

Dr. Harris reported in regard to the work he had been doing in connection with the iso electric point of wool, and the deterioration of silk on exposure to light.

After preliminary remarks concerning the cooperative work of the Research Committee and the Textile Foundation, and the manner in which the allocation from the Foundation had made it possible to continue the work of formulating standards of fastness of dyed textile materials, the chairman introduced Edward T. Pickard, Secretary of the Textile Foundation. Mr. Pickard gave an informal but interesting talk regarding the work of the Foundation, its accomplishments, etc., up to the present time and its future program.

The meeting adjourned at 4:30 P. M.

A. Newton Graves,
Secretary.

Proceedings of the American Association of Textile Chemists and Colorists

Some Fleeting Glimpses of Certain Properties of Sericin*

By **H. H. MOSHER,**
Chief Chemist, U. S. Testing Co.

I HAVE selected as the text for this evening's discourse the subject of "Some Fleeting Glimpses of Certain Properties of Sericin." I had intended originally to present a far more ambitious and pretentious theme delving rather deeply into the physical and chemical aspects of this raw silk component, but lack of time for suitable preparation obviated this possibility and necessitated the substitution of a simpler theme. I am only going to touch upon the peaks and high-lights of the subject and present a few facts not generally known with the hope that they might serve as a nuclei for possible future theoretical studies of practical importance and perhaps explain a few puzzling phenomena occasionally encountered in mill operations.

Raw silk is not essentially a single chemical individual contaminated with dirt and small amounts of fats and waxes, but is comprised of an inner filament of fibroin sheathed in a natural size or lacquer, which is known as sericin or silk gum. This envelopment obscures the brilliance and softness of the silky matter and only after the elimination of sericin can those properties which render fibroin unique among textiles be developed. The amount of sericin occurring on raw silk is by no means a trifling and inconsequential quantity but varies from some eighteen per cent of a whole in Japan to twenty-three per cent in Canton Stock.

It is indeed surprising that this raw silk by-product, the proper elimination of which so vitally influences the quality of the finished product, and which in itself possesses potent properties of potential industrial importance, has received such little consideration and scientific study.

Very few records of studies of sericin appear in the literature and some of these are misleading and inaccurate. Raw silk is generally described as being composed of two chemical individuals, fibroin and sericin, the latter being considered simply an alteration product of silky manner, the conversion of which is caused by water and oxygen at the time the liquid emerges from the spinneret of the worm into the atmosphere. Frequently a table of the products of hydrolysis of both sericin and fibroin follow the cataloging of various other properties. Any bio-chemist can tell at a glance from the varying amounts of amino acids formed that the two proteins are not similar products derived from the same source and differing simply by some minor alteration induced by oxidation and hydration.

Both fibroin and sericin are proteins, it is true and yield upon hydrolysis the same twenty-one components. However, all proteins act in this matter; all are decomposed and synthesized in nature into and from the same twenty-one amino acids, which are generally called in biochemistry the structural units. The physical differences of the various proteins are enormous.

These differences in large measure depend upon the size of the protein molecule, the manner in which the amino acids are linked together and the relative amounts of each structural unit that is contained in the very large protein molecule.

Proteins differing simply because of some minor alteration induced by oxidation and hydration yield upon hydrolysis essentially the same amounts of each structural unit. Such a similarity does not exist in the case of the hydrolytic end products of sericin and fibroin as the chart below indicates.

PRODUCTS OF HYDROLYSIS OF SERICIN AND FIBROIN[1]

	Sericin	*Fibroin*
Glycocoll	0.15	36.0
Alanine	5.0	21.0
Leucine	..	1.5
Serine	6.6	1.6
Phenylalanine	..	1.5
Tyrosine	5.0	10.5
Histidine	4.0	+
Arginine	..	1.0

An examination of the chart shows that fibroin is composed largely of glycocoll and alanine while sericin contain only a relatively small amount of these amino acids. In passing it might be noted that a considerable amount of serine can be secured from sericin upon hydrolysis and fortunately it can be isolated and purified from the medley of hydrolytic products rather easily. Sericin is by far the most abundant source of serine that we have in nature and this product gives promise of developing into a medicinal of definite commercial importance. Serine manufacture should require a definite amount of sericin and a limited amount of silk gum will in the course of the next few years probably be utilized for the preparation of this amino acid.

The widely different amounts of amino acids produced

*Presented at April Meeting, New York Section.

from fibroin and sericin upon hydrolysis suggests a different origin of the proteins in the silk worm body. It has been found that the mechanism for producing raw silk in the larve is comprised of four glands, two being relatively large and situated on each side of the body where they communicate with the spinnerets in the head by means of ducts. Two smaller sacs are located near the head. It has been suggested that the precursors of fibroin are elaborated and stored in the larger glands while the sericin is formed in the smaller sacs and is injected about the fibroin in its passage from its storage basin to the spinneret during the formation of the cocoon.

Several years ago the writer raised and dissected a considerable number of silk worms just prior to the period when they start to form cocoons. The worms were of a species that yield yellow silk and it was found that the colored pigment was contained in the larger glands as a very thick viscous layer adjacent to the cell walls about a core of a more limpid colorless fluid. As the pigment occurring in raw silk is supposed to be disseminated through the sericin, it would seem a natural hypothesis to assume that both the sericin and pigment are elaborated and stored in the same gland.

In one of the very few scientific studies on sericin, Shelton[2] found in 1925 that contrary to popular opinion, silk gum was composed not of a single but of at least two chemical compounds. These he named Sericin A and B. The writer suspected that Sericin A was elaborated in the smaller, Sericin B in the larger glands. If the premise was correct, it was to be expected that the elimination of Sericin A would take place without the accompaniment of any very perceptible amount of color.

Yellow silk was accordingly slowly degummed by enzymes and various reagents which effect an incomplete and slow elimination of sericin. It was found that very little coloring matter was removed from raw silk until between fifty and seventy-five per cent of its gum had been removed. The extract contrary to our preconceived premise was found to contain both Sericin A and B, with the latter predominating, and very little pigment proving these components of silk gum not stored in the large worm gland with the color.

As the natural silk coloring matter is contained at the very cortex of the liquid in this sac, any size covering it must be deposited over it in the passage of the fluid from the reservoir to the spinneret. The only other glands communicating with this duct are the two small sacs located near the head of the worm. Hence, it appears probable that the Sericin A and B are elaborated in this gland and coat the fibroin during the throwing of the cocoon.

It is well known that the elimination of the last traces of silk gum are effected with much greater difficulty than the bulk of the impurities contained on raw silk. It was therefore suspected that the relatively insoluble portion as the sericin associated with and beneath the pigment was an entirely different substance than the more easily soluble sericin fractions.

Accordingly, the samples of yarn from which seventy-five per cent of the gum had been removed was placed in a one per cent soap solution at 180° F. The coloring matter was eliminated easily with the accompaniment of a small amount of additional sericin.

The final traces of gum very slowly entered solution and was not completely freed from the fibroin until temperatures close to boiling had been reached.

These last traces of sericin were isolated from solution and the solubility compared with that of the Sericin B of Shelton. It was found less than one-tenth as soluble, and was hence an entirely different substance.

From this study it would seem that the natural silk pigments are not uniformly distributed through the gum but are confined to a definite layer in the sericin. As this coloring matter is apparently the external layer in the large silk sac in the silk worm body, it would appear that Sericin A and B fractions which envelop the pigment in raw silk are elaborated in the smaller gland near the spinnerets and cover the natural dye which in turn covers a layer of hard relatively insoluble gum, similar to or possibly unorganized fibroin itself. The sericin hence appears composed of three layers, the outer being elaborated by the smaller glands, a middle one being largely composed of pigment and an inner one which is similar to or identical with fibroin itself. The inner two appear to be formed in the main silk gland.

The relative amounts of these sericin fractions on raw silk give promise of being an accurate means of identifying the origin of raw silk. Canton, China and Japanese raw silk were analyzed for the purpose of determining the relative amounts of Sericin A and B in the "gum."

A quantitative separation of these two proteins is simple, but is complicated somewhat by the fact that Sericin B is slowly hydrolized by elevated temperatures and particularly by acids and alkalies into A. However, at temperatures under 115° C. in pure water the transformation is not very rapid.

The separation depends upon the fact that Sericin B is quantitatively precipitated from solution at a pH of 4.1 while Sericin A remains in solution under the same condition.

In order to estimate the amount of Sericin A and B that raw silk contains, the stock is degummed at 115° C. in water in an autoclave under pressure. All of the "A" fraction and most of the "B" enter solution under these conditions. The extract secured is then allowed to cool after which it is adjusted to pH 4.1 by means of very dilute sulphuric or acetic acid. A trace of copper sulphate generally facilitates the separation and renders the filtration a little easier. The Sericin B settles to the bot-

tom of the beaker, after standing from four to six hours, in the form of a flocculent gelatinous precipitate.

As the precipitate clogs the pores of the filter paper and renders the same non-porous in a very short time recourse was made to centrifuging. The deposit in this way can be thrown to the bottom of the tubes, washed and finally transferred to a filter paper and weighed.

The filtrate contains the Sericin A. This is rendered insoluble by 50% alcohol. By diluting the aqueous filtrate with enough alcohol to make a 50%, or better a 75% alcoholic solution, the A Sericin fraction can be separated and weighed.

It was found that the bulk of the sericin is in the form of the "B" modification and varied from a minimum of 14% of "A" in Japan to a maximum of 56% in Canton raw silk.

Altogether we have tested about 50 samples each of Canton, China and Japanese raw silk with the relative Sericin A and B fractions appearing in the chart below:

		Sericin A	*Sericin B*
Japan	(Max. Ser. A Content)	28%	72%
Japan	(Min. Ser. A Content)	14%	86%
China	(Max. Ser. A Content)	45%	55%
China	(Min. Ser. A Content)	31%	69%
Canton	(Max. Ser. A Content)	56%	44%
Canton	(Min. Ser. A Content)	44%	56%

To just what factors these variations in the percentage of Sericin A and B in the raw silk are due, I have no explanation. Whether it can be traced to the strain of the worms, to climatic conditions, differences in the mulberry leaves or some other cause may or may not become apparent upon further studies. The districts in which the olive and other oils, particularly essential, are produced can be very accurately surmised by variations in some particular chemical factor and it seems not improbable that the locality in which raw silk was produced might be similarly deduced. Of course, our results are still too incomplete to have practical importance. We may find upon further study that the relation between Sericin A and B in raw silk varies from season to season and that the spring, summer and autumn crops show such variations that any deductions based on sericin fractions are valueless.

There are some indications that raw silk nature might be similarly detected. However, our work on this subject has not progressed to a point to show any definite trend.

Sericin A and B, though much alike chemically, possess very different physical properties, particularly in respect to their powers of dispersion. Sericin B is a very powerful dispersing and emulsifying agent while Sericin A is almost devoid of such properties.

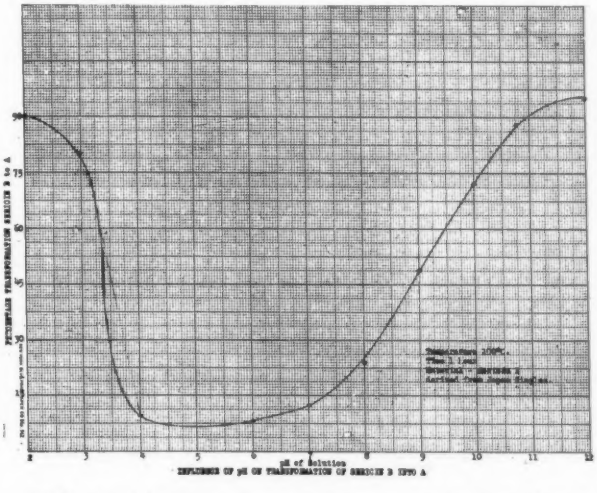
It is to the Sericin B of the silk gum that a boil-off liquor owes its merit as a dyeing auxiliary. If this component is destroyed or removed from solution, the value of the liquor for dyeing purposes is rendered worthless.

Most of the dyers present who have used this solution for coloring purposes have found that at times such liquors break during dyeing. Two causes for the condition may exist.

Soaps, oils and a large number of other chemicals are maintained in a fine state of dispersion by Sericin B. However, there is one point on the pH scale where the protein loses its power of maintaining chemicals in an emulsified form—at pH 4.1 or thereabouts. If a dyebath is adjusted to that hydrogen ion concentration or acquires it for any reason during the process of dyeing, the ability of the solution to retain the colloids and other chemicals in an emulsified state is lost and the material being dyed comes out streaked and greasy.

As I stated elsewhere in this paper, Sericin B is slowly transformed into A at elevated temperatures. Such a change is accelerated by acidity or alkalinity and the more remote the pH of a degumming solution from the neutral point, the more rapid the change.

In the table below I have plotted a curve showing this transformation at various pH values. An inspection of the chart readily shows that a degumming solution containing very perceptible amounts of soda ash or caustic can completely change the Sericin B into the worthless A modification.



While Sericin B is of much importance in dye dispersion and valuable as a dyeing auxiliary, its emulsifying powers renders the recovery of soap from used boil-off liquors difficult.

Practically all treatises dealing with the values to be removed from used textile chemical operations stress the point that tremendous amounts of soap are used in silk degumming and this can be easily recovered by simply adding dilute sulphuric acid or lime to the used liquor and allowing the fatty acids or lime soaps, according to which reagent has been added, to settle. The authors of

such articles certainly never attempted to effect a recovery in the manner that they describe.

I know of a case in which one of the largest and most reputable commercial testing laboratories in the country installed equipment for soap recovery in one of our largest dyehouses with instructions simply to collect the used boil-off liquors in a large storage basin and acidify. It is needless to add that not a pound of fatty acid was recovered in the manner prescribed.

The recovery of fatty acids, however, does not present any particular difficulty if the pH of the solution is controlled. As I stated previously in this paper, the stability of used gum soap liquors is dependent upon Sericin B. At the isoelectric point of this protein, it is precipitated and fats and oils, dispersed by this emulsifying agent, separate. By simply adjusting a used gum soap liquor to pH 4.1 a very rich cream containing the bulk of the fatty acids derived from the soap and all of the Sericin B separate at the top of the solution, leaving a more or less clear fat-free liquor below.

This is one of the few processes which operate more effectively under commercial manufacturing conditions than in the laboratory.

Sometimes certain degumming auxiliaries complicate the recovery and one in particular prevents a satisfactory separation. I refer to hydrosulphites. The manner in which this chemical acts upon the sericin has, to the best of my knowledge, never been determined.

It would appear that the remarkable dispersing and emulsifying properties of Sericin B could be utilized to good advantage to quite an extensive field. Properly peptized Sericin exhibits oil and wax dispersing qualities which can be used in the manufacture of shoe polishes, floor wax liquors and for various other purposes.

Whether economic advantages would attend the use of Sericin for these purposes could only be established upon a scientific investigation.

The cost of recovering the protein should be low. It can be quantitatively removed from boil-off liquor associated with fatty acids and certain pigments and oils. The removal of these contaminants from the sericin apparently presents no particular difficulties and a reasonably pure product of industrial importance result.

Discussion

Chairman Gaede: Are there any questions anyone would like to ask Mr. Mosher?

There is one question I would like to ask, and that is: Can the natural coloring matter be easily separated from Sericin B, that is, in yellow gum silk?

Mr. Mosher: No, it cannot. It can be done in this way: If you bring about a very slow degumming, which will remove the bulk of the outer layer which is comprised of Sericin A and B, you will find that there will be very little coloring matter associated with it, and in that way the bulk of the coloring matter might be separated from those two fractions.

Mr. Jacobs: Does that Sericin B hold its emulsifying properties below 4.1?

Mr. Mosher: It does, all excepting the isoelectric point. You can find, as a rule, if the degumming solution has been thoroughly made, it should be permanent. If you use a considerable amount of caustic in your degumming liquor, or soda ash, you will find that will widen. In fact, it may widen to such a point that it is absolutely worthless and will break under any conditions; but if you are using an alkaline soap, including caustic, it will frequently widen to between 3-5 to as high as 4-8.

Mr. Hanson: Would the addition of a colloid to that soap and caustic prevent this breakdown?

Mr. Mosher: If the pH isn't too high, it would.

Mr. Hanson: You take a protective colloid such as glue and glucose, would it prevent this breakdown?

Mr. Mosher: When you have a protective colloid, there is usually a drop in pH as well. If the pH drops to around 10, it would be valuable. If it doesn't, then it wouldn't. I haven't figures to show just what the pH value would be with a caustic solution which has been protected by means of glue.

There is another point to be taken into consideration there: In order for Sericin B to be of value as an emulsifying agent, it has to be suitably peptized. Caustic soda will not peptize Sericin B.

Mr. Hanson: Have you done much work with the use of enzymes for degumming silks, anything definite?

Mr. Mosher: A great deal. Enzymes will not completely degum silk. They may have value in the degumming of silk and wool. If you give silk a preliminary treatment and a subsequent treatment, you can degum and do a very satisfactory job. But for the use of enzymes alone, the result is not satisfactory without this preliminary treatment.

Mr. Kitt: I would like to ask you a question on this system which I saw work in a place. What has been your experience in a heavy quality piece of goods by putting caustic into it, what effect on the face of the goods have you had afterwards, after the bath has been once used, once or twice?

Mr. Mosher: Excellent.

Mr. Kitt: You don't find a whitening effect? There is a frost onto a heavy pebbled piece of material.

Mr. Mosher: If that re-used soap is maintained accurately at a pH value of 10-2, there shouldn't be the development of any frosting effect. There have been a large number of silk mills in which I have recommended the use of caustic to build it up to its original pH. When it is properly done, it won't frost any more than a fresh soap solution.

Mr. Kitt: I have been in a place where you put the system in, and I followed you and I worked it out quite

a lot. I found that the material would have more of a white face on it, if I take a pure olive soap and put the pieces in the first strip. When they come out, I find them to be much better than when I add the caustic.

Mr. Mosher: There may be a certain amount of yellowing. We made checks in one large silk mill over a matter of a couple of months in which we obtained reports on the silk in which the solution had been rebuilt to a pH value of 10-2 and fresh soap. They made a record of the number of pieces which were imperfect, the number of pieces which were frosted, and when we summed up all the data, the results seemed to indicate but little change, no perceptible difference.

Mr. Kitt: I found it to be very good to force it up that way and bring your liquor back, like Shantungs, to loosen up those black burrs. But on heavy qualities I wouldn't O. K. it.

Mr. Mosher: The companies in which I have put that particular method used red oil. Of course, that shouldn't make any difference. I know we made tests over a considerable length of time and the results seemed to indicate no difference.

Mr. Hanson: In regard to that, Mr. Mosher, we have done a little work along those lines and found, as you say, if it is very carefully watched and checked, the results are excellent. But if they use a protective colloid, there is less chance of running into trouble, using soap and caustic.

Mr. Mosher: Under those conditions, a colloid is very desirable.

Mr. Carter: A number of years ago silk was degummed with caustic soda, and a good amount of glucose passed through it. Have you ever seen the particulars of that?

Mr. Mosher: I think it would be a hazardous method of operation. Of course, a lot of those things are under very careful control and temperature is regulated, and might yield satisfactory results under some conditions. But as a general method of application, I would say it would be a hazardous method.

Mr. Carter: I didn't hear of it being used on any large scale. I saw the patent and made a translation of the patent, and I saw some small samples at the time.

Mr. Mosher: There was a patent taken out a few years ago in which sodium chloride was put in a basin and an electric current of a certain voltage and amperage passed through, and the soap passed through the glue caustic, which was formed in that manner. And I have seen some very excellent pieces of material prepared in that way. On the whole, it was very hazardous because it came out very unevenly in some cases and didn't seem to degum effectively at all.

Mr. Carter: I think if I look up my records, I can give you the dates of the patent numbers and the abstract I spoke about.

Mr. Hanson: There was quite a bit of work done in the past to use protecto in caustic. That also was a continuous process, and as long as everything went in its regular way, the work was very successful. But there should be a breakdown in the machinery or a lapse in one case or another, we ran into trouble. That was its weakness.

Mr. Mosher: That has been my experience with most of those high alkaline liquors.

Chairman Gaede: Any further questions? If not, I will ask if anyone has any further questions to ask Mr. Schlayer?

If there are no further questions, I would like to say in closing, that we certainly have listened to two very interesting papers tonight. They have brought forth quite a bit of discussion on live topics, and I would like to ask for a rising vote of thanks to Mr. Schlayer and Mr. Mosher.

. . . The members present rose and applauded, and the meeting adjourned at 9:45 o'clock P. M. . . .

[1]Abderhalden's Lehrbrich and Physiol Chem. 1909.
[2]E. M. Shelton and T. B. Johnson—J. American Chem. Soc. 47, 412-8 (1925).

APRIL MEETING, PHILADELPHIA SECTION

A meeting of the Philadelphia Section was held on Thursday, April 21, at the Camden Elks Club, Camden, New Jersey. There were 40 members present for the dinner and 52 at the meeting.

Dr. Walter M. Scott presented a very conclusive discourse on the research accomplishment and present lines of endeavor of our research associates and the plans of the research council. The main purpose of the meeting was to create a discussion among the members present regarding the facilities of this nature available to them and to elicit suggestions which would enable our newly formed research group to form an idea of practical problems confronting some of the members.

Various constructive comment was forthcoming and as a whole the group finished with a much clearer understanding of what is being done to assist them and what they can do to be of help.

MAY MEETING, NORTHERN NEW ENGLAND SECTION

THE Northern New England Section met in Riverbank Court Hotel, Cambridge, on Saturday evening, May 7. At dinner 26 were present, and at the meeting 34.

Joseph W. Russell of the Otis Co. spoke on "Meeting the Changing Requirements of Fastness," and John N. Dalton on "Testing Cloth for Perspiration Fastness."

The location for the outing, on Friday, June 10, was changed to the Merrimack Valley Country Club.

Respectfully submitted,

HAROLD C. CHAPIN, *Secretary.*

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

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MOVEMENT TOWARD QUALITY

OF LATE there has been a very noticeable demand in retail stores for goods of quality merchandise. This demand has to a large extent been created by the National Retail Dry Goods Association through its president, P. A. O'Connell of the Slattery Company, Boston, Mass. In every branch of the textile industry there has been a slow but nevertheless perceptible demand for merchandise of good quality. It has been especially noticeable in the woolen market.

The reason for this demand is found in the over-abundance of sleazy material which has been placed on the market in the last couple of years. People have found that they are getting just what they pay for. A $15 suit is worth no more than $15 and over a period of time it is found to be a very poor investment. Cheap merchandise is always an imitation of good merchandise. Manufacturers of quality suitings are overcoming this by producing suitings of plain weaves and the imitators are finding it difficult to cover up the imperfections in this type of a weave. Consumers are becoming price-numb and quality-conscious. They have found that it pays to buy quality rather than a cheap imitation of a good product.

It is the consumer who sets the standard of quality to be followed and when they raise that standard, as they are now doing, the manufacturers and the distributors find it to their best advantage to deliver what is wanted. The National Quality Maintenance League, with Julius Forstmann, manufacturer of the most representative line of quality textiles in business, as one of its leaders, is doing a wonderful piece of work in educating the buyer to demand quality. Women's clubs and other organizations of the kind are educating the consumer to recognize quality and originality of designs.

It is impossible to keep on cheapening goods forever and still maintain acceptable standards. Manufacturers who have been turning out a line of cheap goods may have kept their mills busy but they made no profit. Some of them were running twenty-four hours a day but they were making no money and in many cases they were losing. If some of them stopped to take inventory, they would probably find themselves out of business. It is poor business to force a cheap product on the consumer. It cuts down on the profit involved and the good will of the customer is lost. There is nothing gained but a momentary large turnover, without prospects of repeat orders.

The dyers and the dye producers have suffered as well as the manufacturers and distributors. They have been compelled to use cheap dyes in preference to good dyes in order to keep the price down. The cheaper dyes did not have the fastness qualities of the more expensive dyes. People were dissatisfied. At last they are beginning to learn that they must demand quality to get it and in order to get it they must pay for it. It has been found necessary to work around through the consumer and get him to ask for what he really wanted. The matter of cost has been too important an element. In looking for low prices the ultimate consumer had forced the garment manufacturer to produce lower priced goods and as a result he in turn would demand lower prices from the cloth manufacturer, the dyer, the printer, and the finisher. It generally was the case that it was impossible to furnish anything like quality merchandise at the price demanded. At the low prices demanded it was practically impossible to turn out a fabric that was fast dyed, whereas for a few cents a yard more the cloth could be satisfactorily dyed or printed. The consumer got the goods at the low prices he asked, but he got a lower quality than he had bargained for. They are now beginning to realize this and hence the ever increasing demand for something that is really good.

It is hard to say who has suffered the most in this wholesale production of cheap merchandise. In trying to satisfy the demand for cheaper and cheaper goods the textile manufacturer has gone almost bankrupt attempting to produce them. Yet at the same time the buying public has been sadly fooled when they thought they were getting a bargain. Both the purchasing public and the producers are beginning to find out that there is something besides price to consider when buying merchandise.

Real competition should be based on quality rather than on price. This is what is now coming about. Such a program should be fostered and encouraged in all branches of industry. If the textile industry is the first to realize this, the better off they will be for it. It is certainly an encouraging sign to say the least. The fact that there are strong organizations in back of the movement indicates that it will be successful to a certain degree. To what degree, depends upon what cooperation is given among the individual groups.

Garvan Honored at Luncheon

The presidents and official representatives of 15 national textile and allied associations were guests of the United States Institute for Textile Research, Inc., at the luncheon reception held on Wednesday, May 4th, at the Hotel Biltmore, New York City to Hon. Francis P. Garvan, president of the Chemical Foundation, Inc., in honor of the latter's acceptance of the presidency of U. S. Institute.

Congratulatory letters regretting inability to be present were read from Hon. Robert P. Lamont, Secretary of Commerce; Dr. George K. Burgess, director, Bureau of Standards, Washington, D. C.; Stuart W. Cramer, former president, American Cotton Manufacturers Association and director, The Textile Foundation; and K. P. Lewis, president, Cotton Manufacturers Association of North Carolina.

In addition to the textile association officials who personally honored Mr. Garvan, the following research authorities were guest speakers: Dr. Karl T. Compton, president, Massachusetts Institute of Technology, Cambridge, Mass.; Dr. Charles H. Herty, former president, American Chemical Society, New York City; Mr. Maurice Holland, director, Division of Engineering and Industrial Research, National Research Council, New York City.

Important Research Reported

The luncheon was preceded by an informal reception at which Mr. Garvan greeted the 75 members and guests present. H. V. R. Scheel, vice-president of U. S. Institute, acted as toastmaster at the speaking program following the luncheon, and between luncheon courses several papers and reports on important textile researches completed and in progress were read.

These included a paper on "Electrophoresis and pH," by W. D. Appel, Chief, Textile Section, Bureau of Standards, Washington, D. C., which described some of the practical mill applications in chemical processing of wool and silk of fundamental researches that have defined the iso-electric point of these raw materials; a research progress report by Prof. E. W. Brugmann of Mass. Institute of Technology, indicating that cellulose and cotton lack a definite iso-electric point, and another by Prof. E. R. Schwarz of M. I. T., noting the development of a textile reflectometer of special design for use on fabric wear-testing machines and that will also show the effect of fabric structure upon its reflecting power.

A notable addition to textile literature that is being compiled under the auspices of U. S. Institute and published by Technology Press, Cambridge, Mass., was described by Secretary C. H. Clark under the title "Textile and Allied Research, A Review of Progress." This will provide the latest information as to research and its trend in every important branch of the industry, and for all fibres and processes, each chapter being written by a recognized authority. The book of about 150 pages will be dedicated to the Institute's first president, Dr. Samuel W. Stratton, and will be off the press this Summer.

Formal greetings to President Garvan were extended personally by the following presidents and official representatives of ten of the leading national textile and allied associations: Franklin W. Hobbs, president, National Association of Wool Manufacturers and chairman, The Textile Foundation; George A. Sloan, president, The Cotton-Textile Institute; Walter S. Brewster, president, Association of Cotton Textile Merchants of New York; Ernest N. Hood, vice-president, National Association of Cotton Manufacturers; W. Robert Blum, vice-president, Silk Dyers and Printers Association; Earl Constantine, managing director, National Association of Hosiery and Underwear Manufacturers; P. J. Wood, president, American Association of Textile Chemists and Colorists; August Merz, president, Synthetic Organic Chemical Manufacturers Association; Otto Froelicher, vice-president, Silk Association of America, Inc.

The committee on arrangements for the luncheon-reception was H. V. R. Scheel, vice-president, Botany Worsted Mills and U. S. Institute, chairman; William W. Buffum, treasurer and general manager, The Chemical Foundation, Inc., and C. H. Clark, secretary, U. S. Institute.

Britain's Protected Dye Industry

Sir Harry McGowan, head of Great Britain's dye and chemical combine, disclosed at the recent meeting of that company that five years of determined and laborious effort have resulted in the establishment of a British dye manufacturing industry "which should meet every requirement of the user" in that country. As a general statement, that is true, for under the protection of the Dyesuffs Importation Act, which effectively barred out foreign dyes as soon as British substitutes could be perfected, the Imperial Chemical Industries, Ltd., has made rapid progress in color manufacture.

The achievement of the British dye industry is especially interesting viewed in the light of the developments of the past seventy-five years. Synthetic dye manufacture, which has entirely displaced natural vegetable colors for textiles, had its birth in Britain when Sir William Henry Perkin, in an attempt to produce quinine synthetically, treated aniline with bichromate of potash and obtained, instead of quinine, a violet dye. But chemistry was too "messy" for the scholarly English universities, and, lacking chemists, resources and capital, Perkin was forced to witness the development of the dye industry in Germany, where synthetic coal tar chemistry fired the ambitions and imagination of chemical experimenters. Now, after more than seventy-five years, Perkin's idea attains fulfillment, as Sir Harry McGowan has indicated—*Journal of Commerce.*

Services of Education to Industry*

By **DR. KARL T. COMPTON**
President of Mass. Institute of Technology

HAVING been asked to speak as representative of educational institutions engaged in scientific research for industry, I wish to speak first very briefly regarding the kinds of service which educational institutions are rendering to industry, then to become a little more specific and discuss the service which they are rendering and may render to the textile industry, and finally, to become most specific and express reasons for our satisfaction in the selection of the Hon. Francis P. Garvan as president of the United States Institute for Textile Research.

Educational institutions render both an indirect and a direct service to industry. Of these the direct service is most easily recognized and evaluated, but the indirect service is undoubtedly the more far-reaching and fundamentally important.

The indirect aid to industry is rendered through training the men and through the development of these scientific principles upon which the future engineering and industry will be based. No defense need be made of the importance of training men since to question it would be to question the basic ideas of education to which we are committed. It may be pertinent, however, to point out that the importance of training men is greater now than ever before and is continually increasing because of the increasing complexity in all aspects of life. The time is passing if not already past, when the bright young boy with ingenuity can make effective contributions to the improvement of engineering or of industry. To his brightness and ingenuity must be added a training which is broad and thorough in its fundamentals and yet specialized in its ultimate direction. Our educational institutions are our most effective means of providing this training and if they failed to provide it, other agencies would of necessity arise in their place.

A study of the scientific origins of those discoveries on which have been based the great changes in our material civilization, discloses the fact that nearly all of them originated in universities or similar laboratories. Facts of science are discovered and scientific methods perfected continuously by the men in universities who are interested in the truth for its own sake. Sooner or later a situation arises in which there is a need for some device which can be constructed by the proper combination or application of the preceding scientific discoveries. If this need is of sufficient importance, the discovery of this combination may actually establish a new branch of engineering. In any case, a study of past scientific developments is a most convincing proof of the ultimate practical utility of the pioneer scientific work which is sponsored by our educational institutions.

Turning now to the direct and immediate service of educational institutions to industry, I would call attention to its four important aspects or phases. The members of the staff of educational institutions are frequently engaged for consultation on matters of development or of patent rights or of circumvention of troubles in operation or production. Educational institutions render a very large service by advising industries regarding the selection of their new men. In this respect the personnel service of industries and the placement bureaus of educational institutions form a connecting link which is mutually most valuable and whose operations should be further extended and improved. In many institutions like my own, students are given a cooperative training by the institution and an industry in accordance with the best ideas of both, with great advantages not only in the training of the student but also in the opportunity afforded to the industry to study the performance of these men preparatory to the possible offering of positions to them. Statistics of these cooperating industries show that this procedure has effected for them a relatively large economy through avoidance of misfits and reduction in consequent turnover of staff.

The most direct service of all is the actual undertaking of work in the educational institution designed to solve problems or further developments for particular firms or industrial groups. In this field there are all variations of procedure between that of the Mellon Institute in which industrial research fellows are engaged and set upon problems under the general supervision of a small staff of directors and assistant directors, and that of the Massachusetts Institute of Technology in which problems are taken over by the staff with the assistance of advanced students or industrial research fellows, and where the emphasis is placed upon the advantages of cooperative attack by a very large group of experienced experts. Both methods have met with striking success.

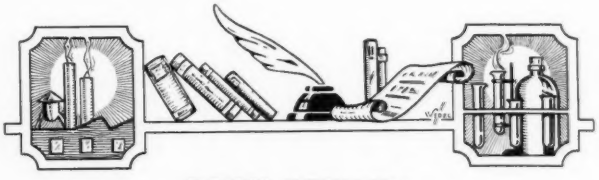
Passing now to the more particular field of textiles, I

*Presented at the luncheon-reception in honor of Hon. Francis P. Garvan, president of United States Institute for Textile Research, Inc., at Hotel Biltmore, New York City, Wednesday, May 4, 1932.

cannot describe the possibilities of cooperation between educational institutions and industries in any better way than to mention the relations that have existed in recent years at the Massachusetts Institute of Technology. In the first place, my honored predecessor, the late President Samuel W. Stratton, was also Mr. Garvan's predecessor as president of U. S. Institute for Textile Research, and was very keenly interested in the problem of finding ways in which science could be made of benefit to the textile industry. In the second place, our Institution maintains a Textile Research Laboratory, where among other things there have been designed about a dozen special machines to be used by industrial firms for testing various mechanical properties of fabrics and fibres. In addition to this laboratory, work on chemical and other aspects of textile problems is being carried out in other departments of the Institute. In the third place, a member of our staff edits "Textile Research Abstracts," a publication which will be of increasing value as research in this field develops, and toward which the Institute is making a financial contribution. In the fourth place, the Institute is carrying on a variety of research problems with the aid of a grant from the funds of the Textile Foundation. In the fifth place, members of the staff of the Institute have assisted the Textile Foundation in planning and putting into operation the Textile Research Fellowships, which are designed to produce centers of textile research in educational institutions all over the country, to attract into the textile field some of the most promising graduate and postgraduate students in these institutions and gradually to make the textile industry "research-minded." It may safely be said that these mutual contacts between the textile industry and the universities will increase in importance and in mutual benefit.

Coming finally to the most particular objective of my remarks, Mr. Garvan himself, I simply wish to say that we in the educational institutions as well as those in other fields, recognize the tremendous service which Mr. Garvan has rendered both to American industries and to the stimulation of research in American educational institutions. Through his work as head of the Chemical Foundation, he has created a new era in the American chemical industry. As part of his far-sighted policy in creating this industry, he has stimulated interest in chemistry, physics and medicine throughout the entire educational plant of the country from the high schools through to the colleges, postgraduate schools and beyond. He has generously contributed his support in directions where the returns were not sufficiently obvious or immediate to gain the support of a man of lesser vision. In supporting scientific publications, in assisting scientific organizations to grow and become self-supporting, in subsidizing projects here and there which are of such fundamental interest as to show ultimate promise of great value, he has played a remarkably effective role in those scientific developments of the past decade toward which we can look with pride and hope.

With this background, the textile industry, which surely needs assistance and far-sighted leadership, is certainly to be congratulated in welcoming the Honorable Francis P. Garvan to the position of leadership in the United States Institute for Textile Research, Inc.



BOOK REVIEWS

Some Physical Properties of Starch Pastes Which Affect Their Stiffening Power on Fabrics
By Margaret S. Furry, assistant textile chemist in the Bureau of Home Economics. U. S. Department of Agriculture Technical Bulletin No. 284, 18 *pages, March,* 1932.

"Some physical properties of starch pastes which affect their stiffening power on fabrics" is the descriptive title of Technical Bulletin No. 284 just published by the Bureau of Home Economics of the U. S. Department of Agriculture. It is a part of a series of studies on home laundering, but has direct interest for the textile manufacturer, and shows the need of scientific information in the selection of starches for sizing yarns and finishing fabrics at the mill. The author is Margaret S. Furry, assistant textile chemist in the Bureau of Home Economics.

The starches studied were potato, corn, wheat, rice, canna, and dasheen, the two latter not thus far used in the sizing of textiles. The smallest granules were found to penetrate the fabric best, the large granules are best for coating. Thus wheat starch, which is composed of very small granules as well as large ones, has both penetrating and coating power. Dasheen, which penetrates most thoroughly and coats the least of the starches studied, and canna, which has little penetrating power but coats very well, have stiffness values very nearly the same. Corn starch is next to canna in its coating power. Rice starch, with very small granules, has high penetrating power. Potato starch, however, which penetrates the least of any of the starches studied, has granules so very large that they slough off, instead of adhering to the yarn, and give very little stiffness.

Thus the author concludes that stiffness in the fabric depends upon the penetrating and coating powers of the starch paste, that these properties depend upon consistency of the paste, and that consistency in turn depends upon the size of the swollen starch granules. The selection of the starch for sizing would therefore be determined by these properties of the starch in relation to the structure of the fabric to be stiffened.

This bulletin is available free on request to the U. S. Department of Agriculture as long as the supply lasts.

Technical Notes from Foreign Sources

Testing of Light-Fastness of Dyeings

Dr. H. Sommer—Monats. f. Textil-Ind. 46, 250 (1931)—A continuation of a paper from an earlier number of the same volume.

The work included in the previous sections of the paper has, according to the author, proved that the coefficient of fading, as a result of its regular relation to the degree of fading, time of exposure, and depth of tone, affords a satisfactory absolute basis for the determination of the fastness of a dyeing toward light. In this paper, he begins his discussion with the statement that, for this purpose, only a standardization of the degrees of fastness to light, on the basis mentioned, is needed, in order for us to be able to give absolutely definite and valid degrees of fastness, in numerical values.

He considers the type-dyeings of the German Fastness Commission to afford a series of steps in which it is easier than ever before to determine the differences between various degrees of fastness. But even a casual inspection of samples exposed according to these specifications shows that the type series, especially the ones for cotton, display decided inequality in degree. In reference to the standards, which have been published, and are doubtless available and more ore less familiar to workers dealing with such matters, Cotton Types I and II are about equal in value, V shows fading which at first is less, then rather more, rapid, in fading; III is fairly similar to V, while with IV, VI, VII, and VIII the progress of fading is fairly regular with increase in exposure. The Wool Types show a greater regularity; apart from the fact that the steps between the types are not quite of equal value, the sequence between V and IV seems to be inverted, and an irregularity in the time/degree of fading ratio in IV appears to exist. The author here adds a table of his findings from a study -test of the Cotton Types, with the Stupho Photometer, the table including the values of the exposure-steps, the alteration in color-tone, the white-content, relative brightness, and full color (these three determined by means of the Stupho), the graphs ("Wegstrecken") in the psychological color-triangle, the degree of fading expressed on percentages, the coefficient of fading, and the half-value time (terms familiar to those who have been following discussions of the subject in recent years). Calculation involving the full-color loss, logarithmic white-increment, logarithmic saturation-decrement, Ziersch's older formula, have been made, and most of the results show a poor agreement with the results of mere visual examination, compared with those obtained by Ziersch's "degree of fading" method. The author has also employed the method of Jost and Fluetsch, and finds that the direct determination of the half-value time is practically impossible, since even with most fugitive dyeings the values of tau (the symbol for half-value time)= 100—200 normal fading hours are obtained. He considers, however, the direct determination of this value to be unnecessary, since it can be derived accurately from other factors easily found by direct determination.

In a brief mathematical discussion following the above, the author plots certain graphs showing the dependence of the degree of fading upon the square root of the number of normal fading hours; the relation is a linear one, but the graphs do not cut the abscissa at 0, but at a certain definite point on the time base, which distance, expressed in normal fading hours, he calls the "Schwellenwert". "Consequently," he says, "it follows that the behavior of a dyeing is characterized completely only by the assignment of the 'Schwellenwert' t_s, and of the corrected coefficient of fading n_1, calculated with consideration of the 'Schwellenwert.' This circumstance makes the exact determination of the light-fastness properties somewhat complicated, since for this calculation at least two exposure steps are required; the calculation itself, for the corrected coefficient of fading, n_1, is expressed by the equation $n_1 = \frac{A\%}{\sqrt{t}-\sqrt{t_s}}$, in which A is the degree of fading expressed in percentages, t is the number of normal fading hours, and t_s is the 'Schwellenwert.' In using this formula, t_s is determined graphically with sufficient accuracy. For the corresponding half-value time, the formula tau $\left(= \frac{50}{n_1} + t_s\right)^2$ $(n = \frac{A\%}{\sqrt{t}}$, and the value of n_1 is given in the preceding formula) is used. In general, the value of t_s can be ignored, when we are dealing with reasonably fast dyeings, or with those in which t_s is less than 2."

The author closes with the statement "In this way it is possible, in testing the light-fastness of dyeings, to work without dependence upon the simultaneous exposure of type-dyeings and the maintenance of a definite duration of exposure. Practically, the determination is carried out by exposing the dyeings to be tested, under the given conditions, in two steps, which can be chosen as about 50 and 100 normal fading-hours, which in summer might correspond to a total exposure of about three weeks. The coefficients of fading, n, of the two exposure-steps will show whether a noticeable 'Schwellenwert' exists, and this can be plotted graphically and given due account

in the calculation of the half-value time. In place of this last value, any other time-unit, such as a quarter-value time, may be selected; in the case of dyeings without a significant 'Schwellenwert,' no alteration in the relation of the degrees of light-fastness will enter the problem; on the other hand, dyeings with a higher 'Schwellenwert' will appear relatively faster to light, as is evident from the dependence, upon the time-factor, of the degree of fading".

It is difficult to find an English equivalent for the term "Schwellenwert". It reminds one of the "threshold-" or "induction-period" value involved in the process of development of photographic emulsions.

Reforms Proposed for the U. S. Patent System

(Continued from page 330)

are so much interested, i.e., process patents, the institution of design patent stands in need of changes that take cognizance of the conditions and needs of present-day industry. Unless the Design Patent system may be so modernized it stands to be supplanted by Design Copyright or Design Registration, a proposed alternative which has found its most enthusiastic advocates in the textile industry but for which Congress has, thus far been reluctant to give the necessary authorization.

At the opening of the 72nd Congress, Senator Dill of Washington State, a member of the Senate Committee on Patents announced that he would, in due course, introduce a series of proposed amendments to the Design Patent law calculated to meet the criticisms of business men as to the shortcomings of the design patent institution and obviate the necessity of transferring responsibility for design protection to the U. S. Copyright Office. Owing to the amount of emergency legislation crowding the Senate calendar at the first session, it developed that design protective legislation, alike to Resale Price Fixing legislation and other special measures, must go over to the second session in December 1932.

Speculation at one stage conjectured the possibility that the Senate solution for the design patent dilemma might be acceptable to the House of Representatives. The latter, however, is disposed to follow its own course. A conference on the subject of protection from design piracy was held early in the year, wherein the issue was discussed by members of the Patent Committee and representatives of design-users. It was agreed that the Committee should receive, for possible introduction at a future date, a design protective bill drafted by the Counsel of the Silk Association of America in conjunction with other interested parties. But, for the time being, the policy of the House Committee is one of placing the present Design Patent law, on probation, so to speak, in order to determine whether a spirit of more complete cooperation or accommodation in the official interpretation and administration of the law may not remove many of the causes of dissatisfaction. One of the chief faults found by the design-using industries with the Design Patent system has been the deliberate routine of examination and certification at the Patent Office. The delays of weeks and months, which have been encountered on occasion, have been disastrous to the safety of short-lived seasonal designs. Patent Office officials promised at the conference above mentioned that they would undertake to speed up routine, reduce the amount of unnecessary red tape, and otherwise strive to ascertain whether the present design patent system might not be rendered sufficient to the needs of owners of original designs.

The general program of patent revision which has advanced to the stage of presentation in bills in Congress still leaves in abeyance certain other proposals in kind which have been put forward by the business community. One of the suggestions yet to be disposed of is the proposal for the inauguration of a new class of patents to cover original designs for machines. A second proposal yet to be acted upon by the legislative planning board on patent matters is that which seeks the establishment of a single court of patent appeals which would have jurisdiction over all patent cases. The success of the U. S. Court of Customs and Patent Appeals, which Congress created a few years ago to review the findings of the U. S. Patent Office, has been so pronounced, especially in the formulation of practical principles as to what constitutes the degree of "invention" worthy of recognition by patent, that there is agitation in business circles for further judicial centralization. All in all, the patent system, at this stage, is anything but static.

Elected Vice-President

Dr. Milton C. Whitaker, formerly Vice-President of the U. S. Industrial Alcohol Company, has been elected a member of the Board of Directors of the American Cyanamid Company, filling the vacancy on the Board caused by the recent death of Mr. J. M. Selden. At the organization meeting of the Board on April 26th Dr. Whitaker was appointed a Vice-President of the Company.

Since joining the American Cyanamid Company in 1930 Dr. Whitaker has devoted his attention to technical and research problems of the Company and its subsidiaries.

Arastick

The Arabol Manufacturing Co., 110 East 42nd St., New York City, is sending out circulars on their product, "Arastick," which is a paste delivered in powder form. It is prepared for use with cold water. According to the distributors, it is suitable for use by canners, bottlers, confectioners, printers, bookbinders, publishers, shoe manufacturers, tobacco manufacturers and manufacturers of paper boxes and paper bags.

To Give A.S.T.M. Marburg Lecture

Professor Hugh Stott Taylor, who is chairman of the Chemistry Department at Princeton University, has been chosen to deliver the Edgar Marburg Lecture at the 1932 Annual Meeting of the American Society for Testing Materials in Atlantic City in June. The lecture commemorates the name of the society's first secretary-treasurer, who, through his development of technical programs over a period of 16 years, brought wide recognition to the society as a forum for the discussion of various aspects of materials used in engineering fields.

The subject for this seventh lecture involves "Fundamentals in the Problem of Resistance to Deterioration." The principles involved are applicable to a wide variety of products, including paints and varnishes, fabrics, rubber, oils and fats, artificial leather and pharmaceuticals.

New Onyx Penetrating Agent

A recent development by the Onyx Oil & Chemical Co., Jersey City, N. J., called Naphthalene Sulphonic Acid Ester, is said to offer the textile industry an exceptionally effective and useful product. Naphthalene sulphonic acid ester is said to combine the action of a dispersing agent, emulsifier and colloidal film breaker in one product. It is claimed that it works equally well on animal and vegetable fibers, cotton, wool, rayon, acetate (celanese), jute, hemp, felts and leather, having various uses for each.

According to the manufacturers, this compound is essentially a powerful penetrant, particularly adapted for the dyeing operating, it is highly concentrated and requires smaller amounts than other penetrants, it works in a neutral, acid or alkaline solution and being exceptionally stable, it is unaffected by hard or calcerous water, acids (mineral or organic), caustics, alkalies, hydrosulphites, bleaching liquids or mordanting agents.

Naphthalene sulphonic acid ester is said to assure level shades on all piece goods, unions and pile fabrics. An economy feature is present in the fact that grey cotton skeins may be dyed without boiling out. Level shades are procured with mixtures of slow and fast exhausting colors. Hosiery, including seams, are claimed to be perfectly dyed and deeply penetrated, regardless of the fiber mixtures.

Other advantages claimed by the manufacturer are:

Tests in vat dyeing, show naphthalene sulphonic acid ester to be a valuable addition to the bath. No insoluble metallic soaps are formed to affect vatting and shades. Air spots in machine dyeing are eliminated. In the jig a quicker, smoother reduction is obtained, giving clear shades and less blinding, as is usually the case with indanthrenes. Difficulties and streaking when using sulphur dyes are overcome. Pressure dyeing is equally successful. Naphthalene sulphonic acid ester carries its beneficial action into the vat printing of cotton and rayon. Good penetration is obtained; bronzing, mottling and dull shades are eliminated. Another important use for this Onyx compound is in its elimination of kier-boiling to obtain a sufficient bleach on cottons, in cases where boiling is likely to produce spots or damage the fiber.

Besides the protection, a subsequent saving of time, labor and steam is naturally effected. When used as a kier-boil assistant, naphthalene sulphonic acid ester is said to produce an intense white in a short time.

German Coal-Tar Dye Exports Show Quantity Increase in 1931

Total German exports of coal-tar dyes showed a quantity increase in 1931 over the preceding year, and a decline in unit value. China, British India, Czechoslovakia Great Britain, the Netherlands, and Belgium were the chief countries of destination for German dyes in 1931.

	1930		1931	
	Quintals	Marks	Quintals	Marks
Aniline and other coal-tar dyes n.e.s.; and sulphur dyes	274,053	132,237,000	322,759	143,526,000
Alizarin red	11,547	1,977,000	13,056	1,991,000
Alizarine dyes from anthracene	24,860	32,076,000	9,294	10,978,000
Indigo, natural and artificial	104,391	24,480,000	92,108	18,686,000
Total.	414,851	190,770,000	437,217	175,181,000

Reorganization at NOPCO

Charles P. Gulick, president of the National Oil Products Company, Harrison, N. J., announces a complete reorganization of Nopco personnel and policies effective May 2. The company will hereafter serve its customers by industries rather than by territorial locations, and department managers have been named by Mr. Gulick to specialize and devote their entire time to various industries which buy products in Boston, Chicago and San Francisco will be maintained in order to render buyers the double service of territorial as well as specialized facilities.

The heads of the various departments taking office are: G. D. Davis, general sales manager; O. E. Lohrke, manager Paint, Oil and Metallic Soaps division; Dr. C. I. Post, manager Tanning Oil division; T. A. Printon, manager Textile Oil division; L. D. Grupelli, manager Technical Sales Promotional Department; Leslie M. Brown, director of sales, Farm Feed Division.

The Nopco Laboratories are headed by Ralph Wechsler. Dr. K. T. Steik is research director. L. W. Davis, Dr. D. S. Chamberlain and R. E. Porter are members of the Technical Service staff.

To Feature Lead Weighting

Believing that a process featuring lead weighting is superior to the established tin weighting process, the United Piece Dye Works has acquired the exclusive right to use the patented method controlled by Max Imhof and Olav Berg, of the Imhof-Berg Silk Dyeing Co.

Lead or salts of lead, described as insoluble, consti-

tute the most important element of the new process, which also consists of a tin salts base. It is said to create a "satisfactory maintenance of strength of fiber and fabric over an extended period."

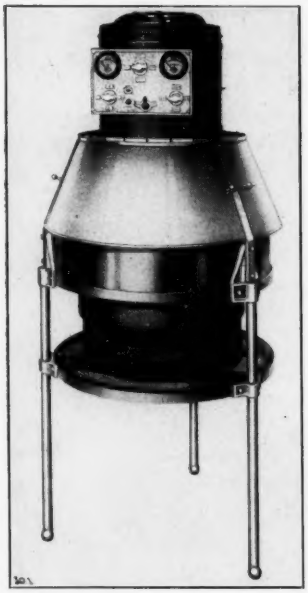
The process, according to Olav Berg, is ideally suited to insure elasticity, tensile strength and durability, which he considers the three fundamental requisites of a finished silk or rayon fabric.

In surveying the market, the United Piece Dye Works has found that the new process is regarded with favor, and that a strong demand for it is expected to develop, due to the advantages that it has over the tin weighting processes. Some of the advantages, the United Piece Dye Works explains, include the fact that lead weighting produces a softer, as well as a stronger fabric, while retaining the desirable effects of tin weighting.

The New Type FDA Fade-Ometer

A new and substantially improved Fade-Ometer has been brought out by Atlas Electric Devices Co., Chicago, Ill. This testing machine, with improved control of voltage, temperature and humidity, is designed to meet the testing requirements attending the present high standards of color fastness.

For fourteen years, Fade-Ometers have been used all over the world to predetermine the light fastness of colors and colored materials, including textiles, dyestuffs, paper, printing and lithographic inks, and wallpaper.



Type FDA Fade-Ometer

An artificial sun is reproduced in the Fade-Ometer by a violet carbon arc light. The specimens to be tested are exposed in holders arranged in a circle around the light. Ventilation is maintained and temperature kept within limits by an electric fan. Humidity is furnished by a water reservoir placed below the specimen chamber. These and other essential characteristics of previous models are retained in the new type FDA Fade-Ometer. This type embodies a number of refinements designed to provide greater precision and more complete control of all the factors attending testing the light fastness of colors.

An aluminum shell, hinged at six points, encloses the specimens which are placed in metal holders. These holders are suspended from a 20 inch ring, surrounding the arc. This arrangement precludes the possibility of the specimens overheating by contact of the holders with other metal.

The water reservoir of polished copper, 29 inches in diameter, forms the base of the machine and serves as a humidifier. A series of wire frames in the reservoir are covered with cotton wicking. These frames rest in four inches of water and provide 1600 square inches of saturated wicking, through which all air coming in contact with the specimens is driven by an electric fan, placed below the reservoir. A relative humidity of 52% to 60% is produced.

The fan is controlled by a DeKhotinsky Thermo Regulator, making it possible to maintain the temperature by automatically starting and stopping the fan between 98 and 105° F. Where higher temperatures are desired as in the case of certain textiles, lithographic inks and auto topping materials, they can readily be attained by resetting the thermostat.

A voltmeter is provided for reading the arc and line voltage and an ammeter for ascertaining that the proper amount of current is consumed. The rotary main line switch and two four point adjusting switches make it possible to control the arc to a very fine degree. A small circuit breaker is provided which will automatically trip, should the current rise above 20 amperes and remain thus for 15 minutes or longer.

The Type FDA Fade-Ometer is made in one size only, capacity 42 specimens, and will replace all previous types, production of which has been discontinued.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

DYER

Six years' experience at bleaching and dyeing wool, cotton, jute and union raw stocks and yarns. Thoroughly experienced in all stages of carpet manufacture. Age, 26; married. Address: Classified Box No. 731, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Textile chemist and microscopist, desires position. Experienced in chemical and textile analysis, textile testing, and production problems of cotton and silk printing, dyeing and finishing and rayons. Good references. Address Arthur K. Johnson, Andover, Mass.